any reliable fact connected with the remains of the wonderful animals may be of value to the biological student.

On the low hills and flats north-east of the gorge of the Rakaia, from 1854 to 1858, there were quantities of gizzard-stones lying in small heaps on the surface of the ground; for years no one collected them for scientific purposes, but boys or bush-hands sometimes turned over the heaps, and picked out a "few pretty ones" that happened to take their fancy.

In April, 1857, with two friends, I went up the course of the Rakaia, followed the southern stream, then through the country west of Mount Hutt and Mount Somers, returned to the "plains" by the Ashburton or Haketere River; this was then all new country, not taken up. On the southern side of the Ashburton or Haketere River, on the flats above the gorge, a vast number of moa bones lay exposed *on the surface of the soil*; after I had taken up a run there, I used frequently to pick up specimens from amongst these bones and throw them into heaps, with the view of making a selection therefrom at some future time.

It may be worth mentioning that near that spot, at a now well-known place called "Paddle Hill," I found a paddle made of totana (*Podocarpus totana*), with a longer handle and much broader blade than any hoe that I have seen used by natives; it seemed too large for a paddler kneeling or squatting; it had probably been used to propel a moki or raft.

The Pahu.—The Hauhaus at the Hikurangi meeting were called to their place of worship by the beating of the pahu; it is a long, sonorous piece of wood, made (when possible) from an aromatic tree called porokaiwhiria (*Hedycaria dentata*). It is hung from a cross pole supported at either end by a forked stick. The sound may be heard to an extraordinary distance. It is produced from this rough kind of wooden drum being beaten on its edges by several persons furnished with short batons.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Cambridge Syndicate appointed to consider the higher mathematical studies and examinations of the university have issued a further report in which they state that they have been led by the observations of members of the Senate in the Arts School, and by the results of the voting on the scheme of examination recommended in their report of March 29, to believe that in the opinion of the Senate the examination in Part III. of the Mathematical Tripos should be independent of the preceding parts, and also that the Senate would be averse to any scheme in which it was not provided that all the subjects should be included in the examinations of each year. They have framed regulations in accordance with these principles in substitution for those rejected by the Senate on May 29, under which it is provided that from the results of the examination in Parts I. and II., the candidates shall be arranged in order of merit as Wranglers, Senior Optimes, and Junior Optimes. Only Wranglers are to be admitted to the examination in Part III., and from the result of the examination in that part only, the Moderators and Examiners shall publish in three divisions, each division arranged alphabetically, a list of those examined and approved. Power is given to the Moderators and Examiners to place in the first division any candidate who has shown eminent proficiency in the subjects of any one group in Schedule III. In each of the papers in bookwork in Part III. a limit is to be fixed to the number of questions to which any candidate shall be permitted to send in answers, such limit to be printed at the head of each paper. The subjects in Part III. are grouped in four divisions. Group A consists of differential equations, calculus of variations, higher algebra, higher parts of theory of equations, higher analytical geometry (plane and solid), finite differences, higher definite integrals, elliptic functions, theory of chances, including combination of observations. Group B, Laplace's and allied functions, attractions, higher dynamics, Newton's "Principia," book i. sec. ix.–xi., lunar and planetary theories, figure of the Earth, precession and nutation. Group C, hydrodynamics, including waves and tide, sound, physical optics, vibrations of strings and bars, elastic solids. Group D, expression of functions by series or integrals, involving sines and cosines, thermodynamics, conduction of heat, electricity, magnetism. From the discussion which took place on the subject on November 2, opinion seems to be pretty much divided at Cambridge as to the advisability of the proposed alterations.

A POST-MASTERSHIP at Merton College, Oxford, for Natural Science, has been awarded to Mr. Geo. Howson, a pupil of Giggleswick School.

SCIENTIFIC SERIALS

Memorie della Società degli Spettroscopisti Italiani, April, 1878, contains a table showing the solar spots and faculæ for each day of observation for the months of January, February, and March 1877. A note by Prof. Tacchini on the solar spots of the first three months of 1877, compared with those of the same months in 1878.—An account of the observations of solar prominences made at Palermo during the first three months of the present year.—Drawings of the chromosphere for the months of March, April, May, and June, 1871.

May.—This number contains full accounts of the transit of Mercury of May 6, 1878, as observed at Rome, with notes on the same by Respighi, St. Ferrari, Millosevich, and Tacchini.—Drawings of the chromosphere for June and July 1871.

June.—Tables of solar spots and faculæ for April and May, 1878.—Note on the spots and solar eruptions of April, May, and June, 1878, by Prof. Tacchini.—A long paper on a cause for the appearance of bright lines in the solar spectrum, by Mr. Meldola.

July.—A paper containing tables of the solar prominences observed at Palermo in April, May, and June, 1878, by Prof. Tacchini.—A long paper by Schiaparelli on the observations of the rotation and topography of the planet Mars made at Milan during the opposition of 1877.

August.—Spectroscopic observations of the chromosphere made at Palermo during the months of April, May, and June, 1878. Tables showing the number of protuberances and spots on the sun for each day of observation for the months of August, September, October, November, and December, as seen at Rome, with notes thereon.—Drawings of the chromosphere for the last part of July, 1871, made at Palermo.

Bulletin de l'Académie Royale de Belgique, No. 7, 1878.—It has been affirmed by more than one observer that, during auroræ boreales, the intensity of scintillation of stars has been considerably increased; a singular influence, if real. M. Montigny, testing such statements, observed twice such an increase (on the nights of April 5, 1870, and June 1, 1878). He notes the fact that this increase coincided with a lowering of temperature of the air in the locality. In the one case this fall occurred exactly at the moment of the aurora and observation of the scintillation; in the other case it preceded the aurora, but was more marked the night of it, and a few hours after observation of the increase in question. He considers the increase due to the cooling, which must have affected first the upper regions of the atmosphere through which the stars' rays pass; and this agrees with the fact that the stars furthest above the horizon showed the increase most.—MM. Spring and Durand study some obscure points in the composition of oxygenated compounds of nitrogen. Finding that the products of reaction, with water, of the body formed by action of chlorine on nitrite of silver, are exclusively nitric acid and chlorhydric acid, their surmise was verified that the chlorine is substituted for the silver of the nitrite, atom for atom, forming nitric chloride. Hence the structure of the group NO_2 of nitric acid is inferred to be the same as that of its correspondent nitrous acid, and the rational formulæ of these two substances must be written respectively HO.N = O and HO.O – N = O. M. Melsens seeks to refute M. du Moncel's statements about the cost of his system of lightning-conductors, as applied to the Hotel de Ville, in Brussels, and criticises the instructions of the Paris Commission for erecting conductors on public buildings.—Some letters in a controversy between M. du Moncel and MM. Navez on the theory of the telephone, appear in this number.—M. Malaise announces the discovery of Brachiopoda of the genus Lingula in the Cambrian formation of Stavelot.

No. 8.—The digestion of albuminoids in some invertebrates forms the subject of a paper here from Dr. Fredericq. From a combination of his results with those got by Hoppe-Seyler and Plateau, it appears that the mechanism of digestion is the same throughout the animal kingdom, and the transformation of food in invertebrates is effected through substances that have the greatest similarity to the digestive ferments of vertebrates (solubility in water, precipitation by alcohol). Digestion by means of

a peptic ferment is very rare among invertebrates; a ferment similar to thrypsine, on the other hand, is met with among different classes of these animals.—M. Plateau communicates an account of experiments (with the graphic method and poisons of the heart), on the movements and innervation of the central organ of circulation in articulate animals. *Inter alia*, section of the cardiac nerve diminishes the number of pulsations (in vertebrates, it produces acceleration).—M. Renard describes the diabase of Challes, near Stavelot, in the Cambrian system.—Dr. Koninck continues his researches on Belgian minerals; and there are some papers on mathematical subjects.

THE *Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg* (vol. xxv. No. 2) contains the following papers of interest:—On the occurrence of the musculus peroneo tibialis in Quadrumana, by Dr. Wenzel Gruber.—On a control barometer, by H. Wild (with plate).—On the reduction of Kirchhoff's spectral observations to wave-lengths, by Dr. B. Hasselberg.—On the observed ingress of Mercury upon the solar disc, at the transit of 1878, May 6, by O. Struve, of Pulkowa (with plate), —Catalogue of forty-two new red stars, by E. Lindemann.—On the Russian species of the mollusc *Clausilia*, Drap., by Dr. Oskar Boettger.—On the theory of curves of the shortest parameter on curved surfaces, by F. Minding.—On the hexylenes resulting from tertiary hexylalcohols and their polymerisation, by L. Jawein.—On the action of tertiary iodide of butyl upon isobutylene in the presence of metallic oxides, by J. Lermontoff. —On tetramethylethyl and its derivates, and on the chemical composition of pinacone, by D. Pawlow.

The Journal of the Russian Chemical and Physical Societies of St. Petersburg (vol. x. No. 6) contains the following papers of interest:—On tetramethylethylene and the chemical structure of pinacone, by M. D. Pavloff.—On the glucose derived from lactose, by M. Foudakovsky.—On the action of bromide of aluminium in the formation of the bromides of aromatic hydrocarbons, by G. Gustavson.—On the dextrogyrate terpene obtained from Russian terpentine, by F. Flavitzky.—On the chemical structure of terpenes, by the same.—On dibenzoyldinitrodiphenol, by M. Goldstein.—On some new mineral springs in the Caucasus, by E. Wroblewsky.—On the influence of the surrounding medium upon electrodynamical actions, by J. Borgmann.—On the determination of the magnetic function of liquids, by the same.

Verhandlungen der naturforschenden Gesellschaft zu Freiburg i. B. (vol. vii. part 2).—From the part we note the following papers: On organic cyanides and their decomposition, by A. Claus.—Note on wine analysis, by the same.—On the equilibrium of a system of expanded molecules and the theory of elastic after effects, by E. Warburg.—Observations on the torsion oscillations of an iron wire heated to redness, by Dr. Messer.—On the sensitiveness of alum crystals towards minute variations in the concentration of their mother-liquor, by F. Klocke.

SOCIETIES AND ACADEMIES

CAMBRIDGE

Philosophical Society, October 21.—Dr. Pearson read a paper on a series of lunar distances taken by him during the years 1875-77, mostly at Cambridge and at a place not far distant, the longitude and latitude of each spot being accurately known. He said that they entirely bore out the conclusions at which he had arrived some time back from a much smaller number of observations, and which were communicated by him to the Society in a paper read by him, March 13, 1876 (see *Proceedings*, ii. pp. 414-418), viz., that the errors are such as cannot be called errors of observation of any kind, and may probably arise from the solution of the spherical problem on which the result depends not being, as at present given, strictly accurate. It was mentioned that there is much to justify this conclusion; for example, this method of obtaining longitudes is not much resorted to now in practice (from which it may be argued that it is actually found inaccurate). It is not formally adopted in Germany, though it still is retained in the *Nautical Almanac*, and in the corresponding publication, the *Connaissance des Temps*, issued at Paris. Capt. Toynbee, F.R.A.S., in a paper in the *Nautical Magazine* for February, 1850 (of which there is an abstract in the *Monthly Notices* of the R.A.S.), distinctly states that lunars taken east of the moon give always a result thirty or forty seconds different from those taken west, though his mean result he says was entirely satisfactory; and until the early part of this century all East Indian longitudes were in error nearly 3m. to the east, a result which very nearly agrees with the errors resulting from these observations, supposing them to have been deduced from the new moon of five to eight days old, probably the most convenient time at which to take them from the sun. The whole series, it was stated, consists of 250 separate distances, each distance being either a mean of three or two, or else only one observation, there being about an equal number of each class, though there is no reason to think that the last are less trustworthy than the others in any serious degree; the Greenwich mean time for each being established, with the exception of a very few, within certainly ten seconds. Only 200 of these, the number at present thoroughly verified, were discussed on the present occasion. Classing these in groups of about forty, it was found that the first group gave thirty-two results where the measured distance was in defect of the theoretical distance, and thirteen in which it was in excess. Assuming the rule given in p. 417 of the paper referred to to be correct, this result exactly agrees with what might be expected, it being almost always most convenient, especially for a beginner, to take lunars, at any rate from the sun, under such circumstances as will give this result, while the example of India, founded apparently on observations made at Madras, seems to imply this probable facility, and also that they were made on the new moon, these being more easily taken in our hemisphere than those made on the old one. In the four remaining groups the proportions are 26 to 18: 28 to 15: 25 to 17: 17 to 14: giving a total of 128 observations in defect, and 77 in excess. Rejecting three or four certainly questionable results, the greatest errors occurring are 2′ 59″ in defect, and 2′ 48″ in excess. The true mean has not yet been ascertained, but is certainly in each case not far from 1′—1′ 20″; which, on an average, will give the observer an error of about half a degree of longitude, or of twenty to thirty-five miles, advancing from our own latitude to the equator. There are probably not a dozen clear exceptions to the rule suggested in the communication of March, 1876, that if the luminaries are both on the same side of the meridian, the observed distance is always in defect of the true if the moon be nearest to it, and in excess if she is farther distant; while the same rule holds good, but with less certainty, when the two luminaries are on different sides. The only exceptions seem to arise where the one more distant from the meridian has a greater altitude than the other, or is of a considerably higher declination, and when the distances are very great, *i.e.* from 120° to 130°, in which case the measured distance seems generally to be slightly in excess of the true; but, as might naturally be expected, these last distances cannot often be taken in our own climate. It was explained that all the reductions had been made by Borda's formula, stated in the *Philosophical Transactions* for 1797 to have been the first strictly mathematical solution of the problem. But the results vary only by a few seconds of arc from those given by the system adopted in the large folio published in 1772 by Mr. Shepherd, Plumian Professor at Cambridge University under the superintendence of the Commissioners of Longitude, and while Dr. Maskelyne was Astronomer-Royal; or from other methods which it is believed are allied to this. Two examples were also exhibited of distances reduced according to the elaborate method suggested by Bessel in the *Astronomische Nachrichten* of 1832; Bessel's results, however, do not differ to any great extent from those obtained otherwise. It was suggested that the problem is really one of spherical trigonometry, and from the fact that the errors seem to depend on the position of the luminaries towards the meridian, whereas the old methods of solution depend on their altitudes, and also that the different ways suggested for eliminating the error due to the difference between the geocentric and geographical latitude of the place of observation give different results, a hope was expressed that if these two circumstances were thoroughly reconsidered in dealing with the question, means might be found of discovering a farther correction of the observed distance, which would give a really accurate result.

MANCHESTER

Literary and Philosophical Society, October 15.—J. P. Joule, F.R.S., &c., president, in the chair.—Relative brightness of the planets Venus and Mercury, by James Nasmyth, C.E., F.R.A.S., Corresponding Member of the Society. "On many occasions, when observing Mercury and Venus in full daylight,